

The reasoning here appears to be scarcely conclusive; there is some unexpressed assumption as to the nature of the action between æther and matter; and that whirls (by which some kind of vortex motion appears to be meant) would necessarily result wants demonstration. These whirls have, at a later stage in the book, to do duty in explaining terrestrial magnetism as well as the relations of the heavenly bodies and their gravitational attraction. Again, p. 11:—

"It has long ago been proved that in æther all bodies fall with equal rapidity towards the centre of the earth, and it may, therefore, be reasonably assumed that all atoms which displace equal amounts of æther have equal weight. There are, however, many and convincing reasons for believing that the atoms of different chemical elements have widely different weights." "The explanation, then, which suggests itself as accounting for this difference, according to the present theory, is the very simple one that the heavier atom is of larger bulk, and displaces more æther than the smaller atom. From this it follows that the sizes of chemical atoms are in the same ratio as their weights."

From this, Gay-Lussac's law and Avogadro's law are derived. Boyle's law and the deviations from it are treated much in the same fashion, and the author then finds it necessary to introduce another factor (p. 15), the *shape* of the molecules. A table of the chemical elements arranged with their atomic weights in ascending order of magnitude (the character—gas, liquid or solid—of each being stated) is given. Arguing from this table, the statement is made:—

"It must hence be admitted that elements with a low atomic weight are much more disposed to be gaseous than those of higher atomic weight, at ordinary temperature and pressure. This quite accords with the theory that their ultimate particles are smaller than those of elements with higher atomic weights."

The difficulty that there are so many solid elements of low atomic weight is got over by invoking the influence of shape. For example, the liquidity of mercury is explained by supposing the atom of mercury to be spherical. A curious reader might wish to know the approximate shapes of the atoms of argon or lithium, but on this point the author is silent. After some pages of the same kind of reasoning, two laws are enunciated:—

(1) "The condition of chemical elements or of chemical compounds, at similar temperature and pressure and under similar conditions generally, depends on their atomic or molecular weights (that is, on the size of their atoms or molecules) and on the shape of their atoms or molecules." (2) "The relative chemical activity and chemical properties of chemical elements or chemical compounds, at similar temperature and pressure and under similar conditions generally, depends on their atomic or molecular weights and on the shape of their atoms or molecules."

The term law appears to be used here in a somewhat unusual sense, as these statements do not constitute laws; to make them such, the laws of dependence should be known. Another good example of the author's mode of reasoning is to be found on pp. 53, 54, where the fact that glass is transparent to light

but opaque to heat is explained by the peculiarities of the interstices filled with æther in the case of glass, the nature of these being inferred from the way in which glass fractures.

It will appear from these examples of the author's treatment that his theory cannot even make good a claim to be considered a reasonable working model. A great number, however, of the better known physical and chemical phenomena are brought together, and on this account the book may perhaps prove interesting to readers who have not sufficient leisure or inclination for the perusal of treatises and memoirs that have greater pretensions to scientific accuracy.

FOUNDRY PRACTICE.

General Foundry Practice. By A. McWilliam and P. Longmuir. Pp. vii + 383. (London: Charles Griffin and Co., Ltd., 1907.) Price 15s. net.

THE opinion is generally held among metallurgists that with the rapid progress made of recent years in Great Britain in the metallurgy of iron the foundry has hardly kept pace. Mr. McWilliam and Mr. Longmuir take a more optimistic view, and believe that advances have been, and are being, made of a magnitude commensurate with those of other industries. Certainly signs of progress are apparent in this important branch of metallurgy. The empirical method of charging the cupola is giving place to the system of weighing all materials in proportions determined by the chemist. High-temperature measurement is being practised in the core and drying stove. The field for machine moulding is extending. Permanent moulds made of carbon or similar material are being tried; and the founder is just realising the fact that micrographic analysis has a commercial value. In short, in all branches of his work he is showing a praiseworthy desire to emerge from the slipshod ways of the past. The literature of the subject has, however, remained meagre, and not of a strikingly scientific character. Scattered through the pages of the *Journal of the Iron and Steel Institute* and of the iron trade journals there is much information of permanent value; but the special treatises on the subject are mostly of an elementary character. The exhaustive work by Mr. McWilliam and Mr. Longmuir may therefore fairly be regarded as marking an epoch in the history of iron founding, and should help greatly in effecting a clear understanding of the subject. The authors possess special qualifications for the work they have undertaken. Mr. Longmuir has held the position of foundry foreman, and is a Carnegie research medallist of the Iron and Steel Institute, while Mr. McWilliam, a distinguished Associate of the Royal School of Mines, has at the University of Sheffield had ample opportunity of ascertaining the needs of students. They have therefore been able to draw upon experience gained under normal foundry conditions and under the conditions of experimental laboratories, and the operations they describe have been personally followed.

The subject-matter is dealt with under the following heads:—General properties of matter; moulding sands; facing sands; foundry tools; moulding-boxes; handling material in the foundry; open sand moulding; cores; elementary aspects of moulding; green-sand moulding; securing cores in moulds; moulding from guides; bench, outside, and plate moulding; machine moulding; dry sand moulding; loam moulding; chill casting; casting on to other metals; weighing and binding moulds; shrinkage, contraction, and warping; dressing castings; common faults due to mould and pattern; wrought iron; cast iron; refractory materials; fuels and furnaces; mixing by analysis; further treatment of cast iron; high-temperature measurement; steel; metals other than iron; alloys; mechanical testing; micrographic analysis; common faults due to the metal; and foundry management. The illustrations, of which there are 246, have been carefully chosen, and, like the letterpress, are exceptionally well printed. From this enumeration of the contents it will be seen that, although bearing the comprehensive title of "General Foundry Practice," the work is almost entirely devoted to iron and steel founding. Metals other than iron are disposed of in some twenty pages, brass founding receiving chief attention. The ingenious *cire perdue* process of bronze casting is not mentioned, nor is the modern method of casting in sections bronze statuary of heroic size, such as Bartholdi's "Liberty" at New York and Schwanthaler's "Bavaria" at Munich. The plaster moulds used for this purpose might have been added to the green sand, dry sand, loam, and chilled moulds described by the authors. A few lines, too, might have been devoted to the moulds used for metals with low melting points, brass, slate (for toy soldiers), wood, and even paper (for stereotype plates) being employed.

As the eye of the metallurgist wanders up and down the authors' well-filled pages, it will be arrested by that section which deals with the influence of the various impurities in cast iron. Phosphorus, it is shown, increases the fluidity of cast iron and renders the metal suitable for art castings, such as those for which the Russian works at Kyschtym are famous. Sulphur tends to make castings harder and brittle. Silicon, by tending to throw the carbon out of the combined form and to make it appear in the metal as graphite, has a beneficent influence. Manganese, on the other hand, has a tendency to keep the carbon in the combined form. These facts have to be borne in mind in mixing by analysis, a method which, it is gratifying to find, is steadily replacing mixing by fracture, by guesswork, or by trial. As the underlying science of the founder's art becomes more and more clear, well-marshalled knowledge is increasingly helpful. As the authors point out, the real theoretical knowledge of the man of science is built on experiment, and his theories are tested by further experiment. The practical man constantly meets with difficulties in his work; and he also must, in a truly scientific way, devise a remedy by testing the results of his

former experience. The apparatus may be cruder than that of the laboratory, but it will be used with a subtle judgment of the needs of the case. The man who combines a scientific training with practical experience is gradually, but surely, becoming the dominant type of industrial captain in the best equipped foundries.

The book is unusually free from typographical and other errors, and there is little in the arrangement of the material to which exception can be taken. It might perhaps have been well to have carried the subject a stage further, and to have given the student some information regarding the galvanising, nickel-plating, lacquering, and porcelain enamelling of castings, and regarding the repairing of faulty castings by melting in iron by means of the electric arc or the oxyhydrogen blow-pipe. Pattern making is altogether ignored. It is true that it is a distinct trade involving the skill of the joiner and the turner. A practical founder should nevertheless have a general knowledge of the construction of foundry patterns; and the elaborate patterns, sharply chased in a tin-lead alloy, used for ornamental castings present many features of interest to the foundry managers and foremen for whom the work is primarily intended.

OUR BOOK SHELF.

Eversley Gardens and Others. By Miss R. G. Kingsley. Pp. x+280. (London: George Allen, 1907.) Price 6s. net.

It is always stimulating to meet enthusiasm, and Miss Kingsley is not only an enthusiast with regard to individual plants, but possesses a keen eye for their artistic setting and arrangement. *Eversley* is situated on the Bagshot beds in a part of Hampshire that has received the *sobriquet* of "the rubbish-heap of the world"; and as much of Miss Kingsley's experience was gained in laying out and cultivating the garden of Keys House, in Eversley, her success may serve as a help to other amateurs whose energies are also concentrated on poor soil.

It would appear that roses have been Miss Kingsley's chief delight, especially the teas, hybrid teas, and climbers. She presents a lengthy choice, arranged in colour groups, containing besides such universal favourites as G. Narbonnand, Frau Karl Druschki, and Caroline Testout, others less generally known, as Madame Ravary, Coquette de Lyon, and Monsieur Trillier. The list of rhododendrons, a plant that finds a congenial home on the Bagshot soil, is especially noteworthy, and the plan of growing bulbs in peat fibre in bowls is recommended as a clean and rapid method for producing fine flowers. While it is probable that most gardeners will find many hints and references to species unknown to them, it is certain that all can learn much from the artistic combinations described by the author, some produced in her own garden, others in her friends' gardens.

The Friendly Stars. By Martha Evans Martin. With introductory note by Prof. Harold Jacoby. Pp. ix+253; illustrated. (London and New York: Harper and Brothers, 1907.) Price 5s. net.

EVIDENTLY written by one who for years has been in the habit of looking upon the stars as companions, rather than as conglomerations of known and unknown elements, this volume will appeal to the